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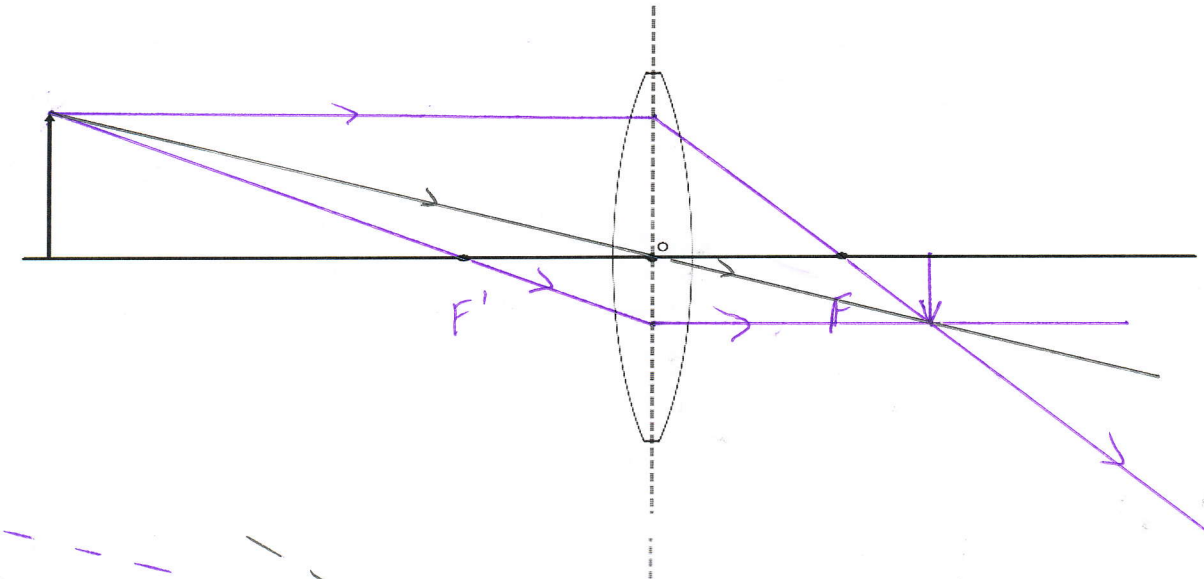
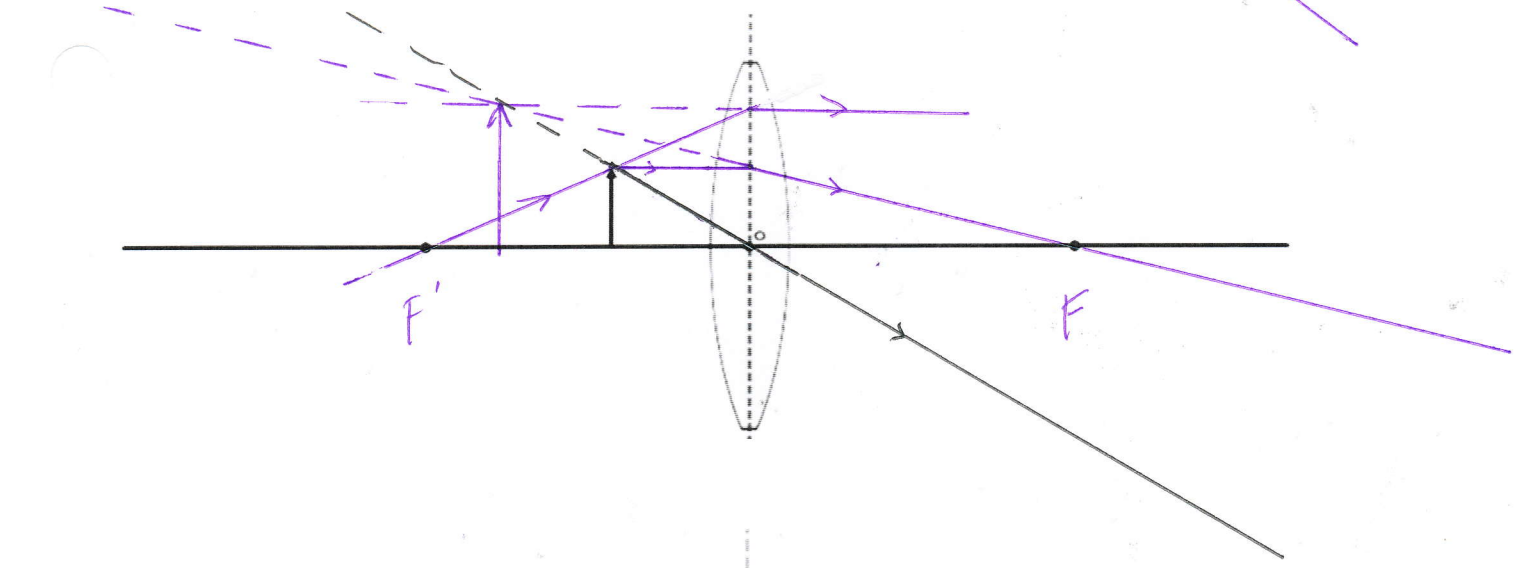
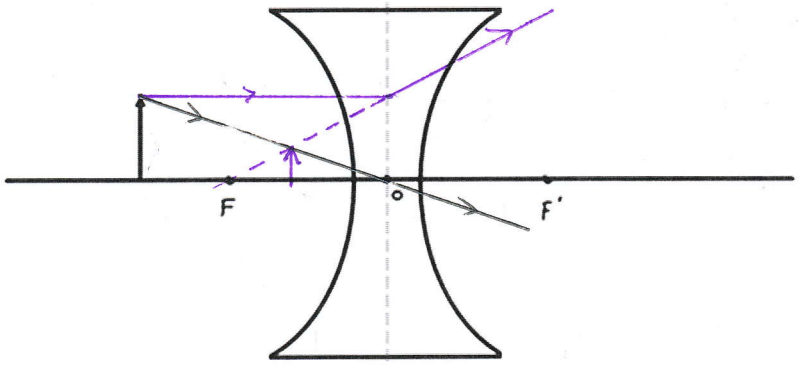
Optics Review

Ray Tracing

Trace the rays for the following ray diagrams.







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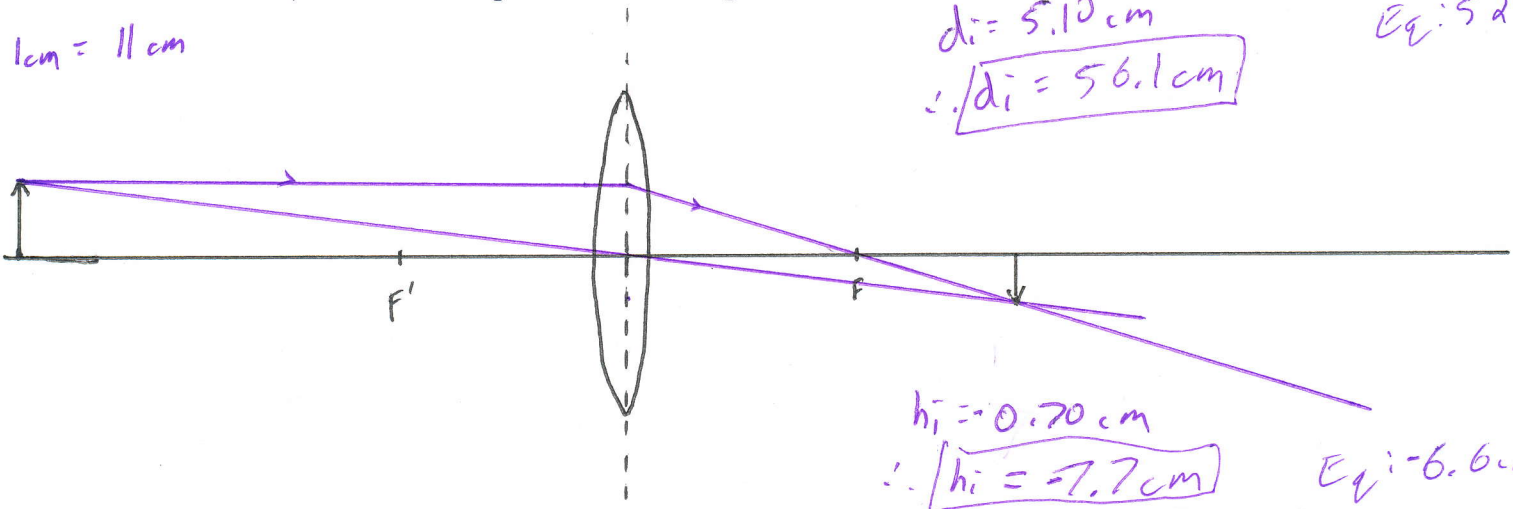
Scale Diagrams

Solve the following questions by using a scale diagram.

1) An object 11.0 cm high is placed 88.0 cm in front of a converging lens. If the focal length of the lens is 33.0 cm, what is the image distance and height?



1cm = 11 cm

$d_i = 5.10$ cm

$\therefore d_i = 56.1$ cm

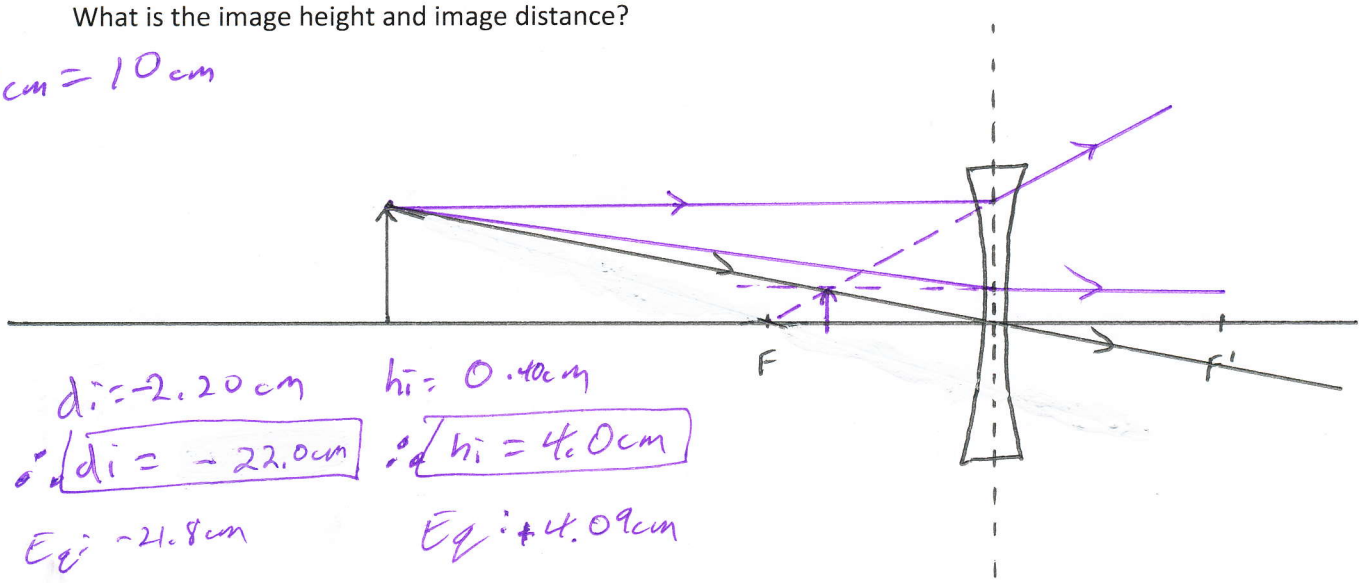
Eq: 52.8cm

$h_i = -0.70$ cm

$\therefore h_i = -7.7$ cm

Eq: -6.6cm

2) A light 15.0 cm high is placed 80.0 cm in front of a diverging lens that has a focal length of 30.0 cm. What is the image height and image distance?



1cm = 10cm

$d_i = -2.20$ cm

$\therefore d_i = -22.0$cm

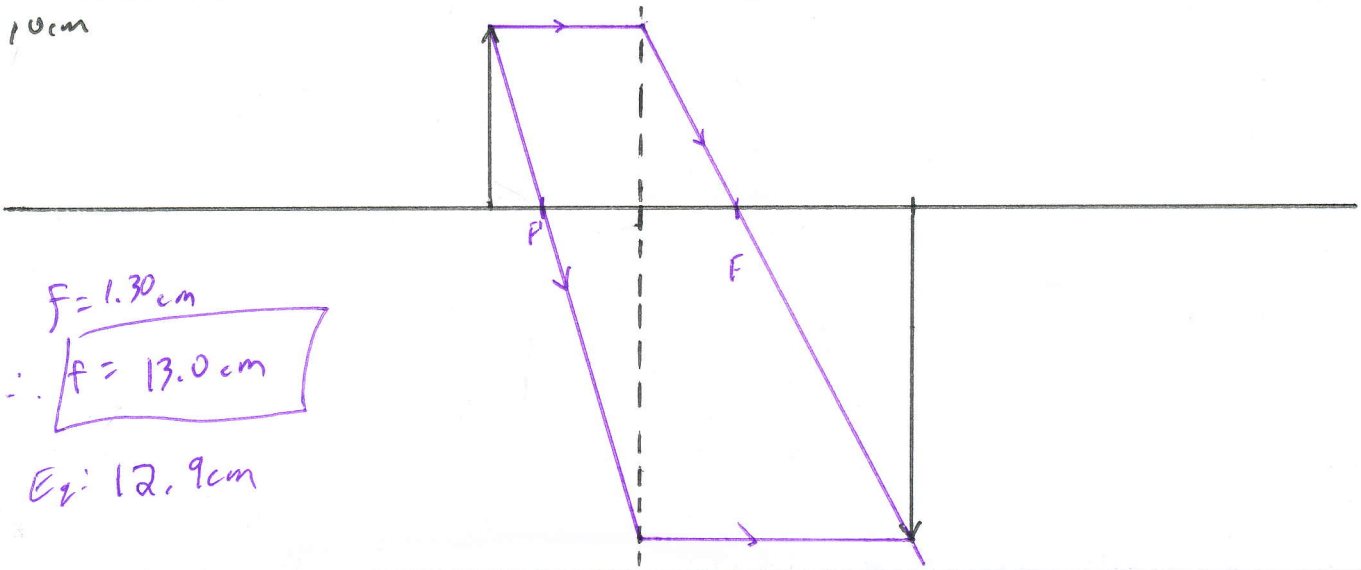
Eq: -21.8cm

$h_i = 0.40$cm

$\therefore h_i = 4.0$cm

Eq: 4.09cm

3) In a converging lens, a 24.0 cm object 20.0 cm from the lens creates a real, inverted image that is 44.0 cm tall and 36.0 cm from the lens. What is the focal length of the lens?



1cm = 10cm

$F = 1.30$cm

$\therefore f = 13.0$ cm

Eq: 12.9cm

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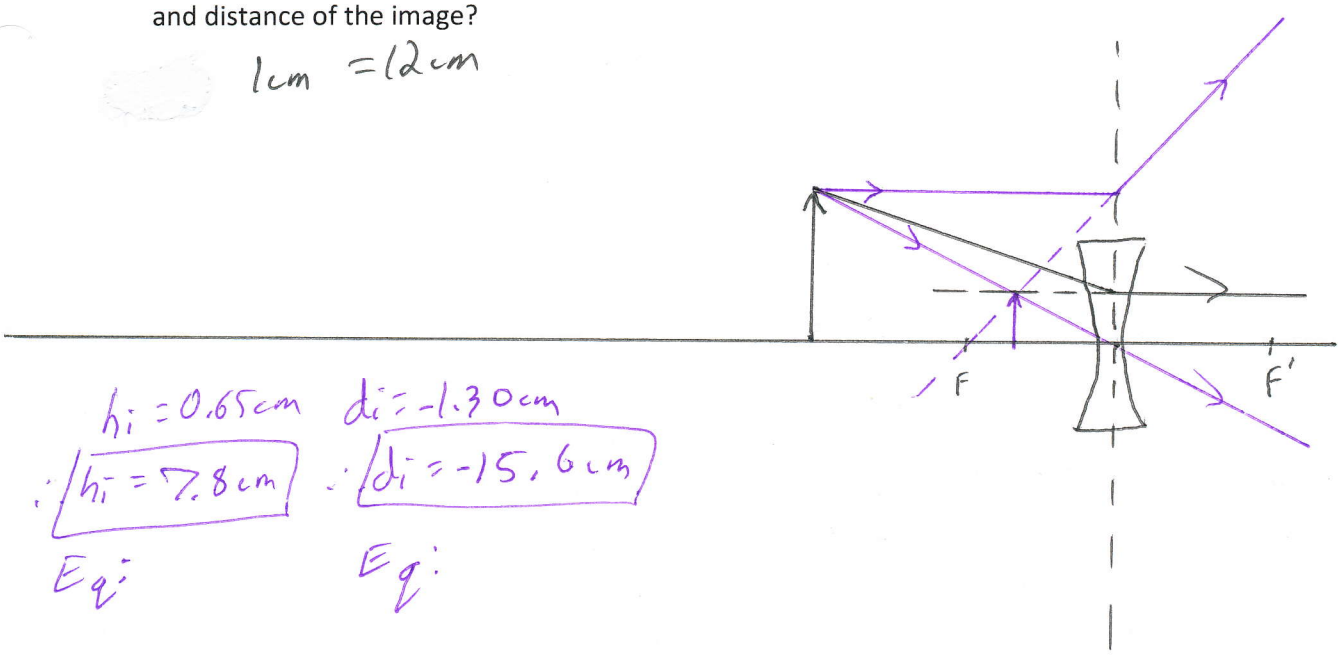
4) A 24.0 cm object is 48.0 cm in front of a diverging lens with a focal length of 24.0 cm. What is the height and distance of the image?

1cm = 12cm



$h_i = 0.65\text{cm}$ $d_i = -1.30\text{cm}$

$\therefore h_i = 7.8\text{cm}$ $\therefore d_i = -15.6\text{cm}$

Eq: Eq:

Math With Lenses

Use equations to solve the following questions.

1) Solve the "Scale Diagram" section using equations.
2) An object is placed 9.00 cm from a diverging lens. The object is 4.00 cm tall and the focal length of the lens is 5.00 cm. Determine:
   a. The distance between the image and the lens. (-0.311 cm)

$d_o = 9.00\text{cm}$
$h_o = 4.00\text{cm}$
$f = -5.00\text{cm}$
$d_i = ?$

$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$

$\frac{1}{f} - \frac{1}{d_o} = \frac{1}{d_i}$

$\frac{1}{-5.00\text{cm}} - \frac{1}{9.00\text{cm}} = \frac{1}{d_i}$

$\frac{-14}{45.0\text{cm}} = \frac{1}{d_i}$

$-45.0\text{cm} = d_i$

$d_i \approx -3.21\text{cm}$

   b. The size of the image. (0.138 cm)

$h_i = ?$

$\frac{h_i}{h_o} = \frac{-d_i}{d_o}$

$h_i = \frac{-d_i h_o}{d_o}$

$h_i = -\frac{(-3.21\text{cm})(4.00\text{cm})}{9.00\text{cm}}$

$h_i \approx 1.43\text{cm}$

   c. Whether the image is real or virtual. How do you know? (Virtual)

Virtual => Diverging lens, d_i is negative, h_i is positive

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3) A 6.00 cm tall candle is placed 9.00 cm from a converging lens with a focal length of 8.00 cm. Determine the location of the image and the magnification. Is the image upright or inverted? (72.0 cm, -8.00, Inverted)

$h_o = 6.00\text{cm}$
$d_o = 9.00\text{cm}$
$f = 8.00\text{cm}$
$d_i = ?$
$m = ?$

$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$

$\frac{1}{f} - \frac{1}{d_o} = \frac{1}{d_i}$

$\frac{1}{8.00\text{cm}} - \frac{1}{9.00\text{cm}} = \frac{1}{d_i}$

$\left(\frac{1}{72.0\text{cm}}\right)^{-1} = \left(\frac{1}{d_i}\right)^{-1}$

$d_i = 72.0\text{ cm}$

$M = -\frac{d_i}{d_o}$

$M = \frac{-72.0\text{m}}{9.00\text{cm}}$

$M = -8.00$

Inverted (M is negative)

The Eye

Know how an eye works.

Know the parts of the eye.